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the end of which time he gave signs, although somewhat uncertain, of recovering his vision. The animal is well cared for in order that the author may continue his observations for some time to come; then later, he will be sacrificed in order that a complete study may be made of the new formation. (Revue Scientif. 1895, p. 406.)

ENTOMOLOGY.[1]

Domestic Economy of Wasps.—Much attention has recently been given to the biology of wasps. One of the most interesting accounts is that of M. Paul Marchal[2] summarized in the Annals of *Magazine of Natural History.* The investigator studied the earth-burrowing wasps (*Vespa germanica, V. vulgaris*). The fully-formed nests contain small and large cells, the latter constituting two or more of the lowest combs, while the others make up the six to ten upper combs. The large cells, built only by the workers in August, may, at an early period, receive indifferently either females or males, the former being either queens or very large workers, the latter always in small proportion ; after the first of September these cells are entirely set apart for the queens, so that in October no males are to be found in them.

The small cells, from the time that the laying of eggs for males has begun, contain indifferently up to the end of the season either workers or males. The proportion of males in the combs of small cells decreases from below upwards, with this remarkable exception—that if there be a mixed comb containing both large and small cells, the small cells are influenced by the proximity of the large cells, and contain very few males.

The beginning of the period for laying males coincides very nearly with the time of appearance of large cells, early in August. The curve which represents their production rises suddenly in an almost vertical manner to reach its maximum ; it then descends gradually with or without oscillations to the end of the reproduction. The queen takes a prominent part in this great production of males, because the laying workers have already long since disappeared, whilst the young male larvæ are still to be found in great numbers in the nest.

The queen has then (at least after the early days of September) the power to determine with certainty the female sex of the eggs which she lays in the large cells; on the other hand, she lays indifferently either female or male eggs in the small cells. One can only admit in order to explain this remarkable fact, the principle of the theory of Dzierzon, based upon the fecundation, because if the production of males were due, for example, to the influence of season, it is evident that the eggs laid at the same epoch in the large cells would become male just as much as the others. In order to interpret all the facts, M. Marchal thinks this theory should be modified, by allowing the intervention of another factor than the will of the queen, and continues: We will admit, then, that after her first deposit of eggs, exclusively those of workers, which lasts until the first of August, the reflex which brings about the contraction of the seminal receptacle at the moment of the laying of each egg is no longer produced with the same energy, and that therefore the eggs can be laid without being fecundated; thence the almost sudden appearance of males corresponding to the relative state of inertia of the receptacle. Then it is that the workers building the large cells give the queen a choice between two distinct classes of the alveoli, and she, stimulated by the presence of the large alveoli, which seem to possess the power of rendering her reflexes more energetic, will concentrate from that time all her energies upon them and will lay only fecundated eggs and females. The modification thus introduced into the theory is important because it replaces the voluntary act of the queen by a passive one. The queen does not deposit males and females at will; but there comes a time when she cannot do otherwise than deposit males, because of the relative inertia of her receptacle.

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[1] Edited by Clarence M. Weed, New Hampshire College, Durham, N. H.

[2] *Comptes Rendus*, t. cxxi, pp. 731–734.

M. Marchal finds that the laying of eggs by workers is normal in August to a small extent, and that it is greatly increased in case the queen is removed or stops laying.

Circulars on Injurious Insects.—A valuable series of circulars on injurious insects is being issued by the United States Division of Entomology. In each, one of the more important pests is discussed, its method of work, distribution, life-history, natural enemies and remedies being clearly described. Recent issues include circulars 9 to 15, with the following titles: Canker-worms, by D. W. Coquillet; The Harlequin Cabbage Bug, by L. O. Howard; The Rose Chafer, by F. H. Chittenden; The Hessian Fly, by C. L. Marlatt; Mosquitoes and Fleas, by L. O. Howard; The Mexican Cotton-Boll Weevil, by L. O. Howard, and Shade Tree Insects, also by Mr. Howard.

Gypsy Moth Extermination.—The last Report of the Massachusetts Gypsy Moth Commission shows that decided progress has been made in checking the pests. About $130,000 was spent during 1895. In commenting on the policy of State control of the pest, Prof. C. H. Fernald writes:

The value of the taxable property in this State is $2,429,832,966, and an appropriation of $200,000 is a tax of less than one-twelfth of a mill on a dollar. A man having taxable property to the amount of $5,000 would have to pay a tax of only 41 cents and 6 mills. This beggarly sum of money would make but a small show in the work of clearing gypsy moth caterpillars from an infested $5,000 farm, while in the uninfested parts of the State the land owners would be paying an exceedingly small premium to the State to insure them against the ravages of the gypsy moth. This premium on a $1,000 farm would be 8⅓ cents, and for fifty years it would amount to only $4.16⅔ cents. This protection would extend not only to farmers and owners of forest lands, but also to residents in villages and cities who own lots with trees and shrubs on them, and to vegetation wherever grown within the limits of our Commonwealth.

Entomological Notes.—Messrs Howard & Marlatt publish, as Bulletin No. 3, of the United States Division of Entomology, an elaborate discussion (80 pages) of The San José Scale: Its Occurrences in the United States, with a Full Account of its Life-history and the Remedies to be used against it.

In reporting[3] on the 1895 experiments with the Chinch-Bug diseases, Prof. F. H. Snow says that the year's experience corroborates the conclusion of former years that *Sporotrichum* is ineffective unless the weather conditions favor its development.

In Bulletin 36, of the Hatch Experiment Station of Massachusetts, Messrs Fernald and Cooley discuss the imported Elm Leaf Beetle, the Maple Pseudococcus, the Abbot Sphinx and the San José Scale.

Some potato insects are discussed by Prof. H. Garman in Bulletin 61 of the Kentucky Experiment Station.

Mr. M. V. Slingerland continues the excellent entomological bulletins from the Cornell University Experiment Station. Recent issues deal with Climbing Cutworms (Bulletin 104), Wireworms and the Bud Moth (107) and the Pear Psylla and Plum Scale (108).

In Bulletin No. 43, of the Minnesota Experiment Station, Prof. Otto Lugger discusses Insects Injurious in 1895. The Bulletin covers about

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[3] Fifth Report of Experiment Station of the University of Kansas. Lawrence, 1896.

150 pages with sixteen plates, and shows that a large amount of work has been done. The entomological department has a special annual appropriation of $5,000 which enables it to carry on extensive field experiments.

In the December, 1895, Bulletin of the Tennessee Station, Chas. E. Chambers discusses the Chinch Bug.

Mr. Frank Benton's admirable Manual of Instruction in Apiculture, issued as Bulletin No. 1, New Series of the United States Division of Entomology, is being most cordially welcomed by the bee keeping fraternity.

EMBRYOLOGY.[1]

Morphology of the Tardigrades.[2]—R. v. Erlanger has published the results of his observations on the early development of *Macrobiotus macronyx* Dujardin. The division of the egg is total and equal, segmentation resulting in the formation of a long oval blastula with the segmentation cavity located nearer the posterior, more pointed pole. Regular gastrulation takes place, with the cells of both ectoderm and entoderm at the anterior more flattened, pole considerably larger than those posterior to the blastopore, this difference being noticable throughout the entire development. The embryo bends ventrally and the entoderm becomes constricted into two sections, the anterior, the germ of the œsophagus together with the sucking stomach and the posterior, the germ of the true stomach. The ectodermal cells of the anterior and ventral walls increase in number and size, representing respectively the starting points of the eyes and ventral nerve chain. The hind gut, extending dorso-ventrally, represents the third division and is in open communication with the blastopore. In the ensuing stage the blastopore becomes closed and later the true anus breaks through in the same place.

Up to this stage the embryo has consisted of but the two primary germ layers. The mesoderm develops as paired cœlomic pouches from the Archenteron, the first pair appearing at the posterior end of the embryo forming the fourth segment, the second pair in the anterior end giving rise to the first segment, the third pair in the second segment

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[1] Edited by E. A. Andrews, Baltimore, Md., to whom abstracts reviews and preliminary notes may be sent.

[2] Morph. Jahrbuch., Bd., XXII, 1895.